VERMICULITE

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Vermiculite production and consumption declined by about 5% in the United States. Worldwide vermiculite production increased to 510,000 metric tons (t) in 2004. U.S. exports dropped by one-third to 10,000 t, while imports almost doubled to about 69,000 t. The average price of U.S. exfoliated vermiculite sold or used by producers increased by 5% compared to that in 2003.

Vermiculite is a hydrated magnesium-aluminum-iron silicate, with a generalized formula of $(Mg,Fe^{+2},Al)_3(Al,Si)_4O_{10}(OH)_2 \bullet 4H_2O$ (Fleischer and Mandarino, 1991, p. 211). Deposits of vermiculite are generally associated with ultramafic rocks rich in magnesium silicate minerals. Vermiculite is a secondary mineral formed primarily by the alteration of mica and less commonly by alteration of amphibole, chlorite, olivine, pyroxene, or other clay minerals. Flakes of raw vermiculite concentrate are mica-like in appearance and contain water molecules within their internal structure. When the flakes are heated rapidly at a temperature of 900° C or higher, the water flashes into steam, and the flakes expand into accordion-like particles. The color, which can range from black and various shades of brown to yellow for the raw flakes, changes upon expansion to gold or bronze. This expansion process is called exfoliation, and the resulting lightweight material is chemically inert, fire resistant, and odorless. In lightweight plaster and concrete, vermiculite provides good thermal insulation. Vermiculite can absorb liquids such as fertilizers, herbicides, and insecticides, which can then be transported as free-flowing solids (Harben and Kuzvart, 1996).

Production

Domestic production (sold or used) data for vermiculite were collected by the U.S. Geological Survey (USGS) from two voluntary canvasses—one for mine-mill (concentrator) operations and the other for exfoliation plants. Production data for nonrespondents were estimated using employment data and/or adjusted production reports from prior years. The two U.S. producers of vermiculite concentrate were Virginia Vermiculite Ltd. with two operations (near Woodruff, SC, and in Louisa County, VA) and W.R. Grace & Co. from its operation at Enoree, SC.

Vermiculite concentrate was shipped to exfoliating plants for conversion into lightweight material. Output of exfoliated vermiculite sold or used in 2004, using actual and estimated data, was 90,000 t, which included both domestic and imported material (table 1). Exfoliated vermiculite was produced by 15 companies operating 19 plants in 11 States (table 2). Of the 19 exfoliation plants, 11 responded to the annual canvass, representing 70% of the estimated sold or used exfoliated vermiculite listed in tables 1 and 3. Data for the remaining operations were estimated from previous years' reported and estimated production levels. States that produced exfoliated vermiculite, in descending order of estimated output sold or used, were South Carolina, New Jersey, Pennsylvania, Arizona, Florida, Arkansas, Massachusetts, Illinois, Texas, Ohio, and New Mexico.

Stansbury Holdings Corporation announced that two mortgage foreclosure proceedings against the company's Montana vermiculite properties have proceeded to final judgment. Sheriff's sales subsequently divested the company of all of its vermiculite claims and properties in Montana (Stansbury Holdings Corporation, 2003§[1]). Montana Mining took ownership of the Elk Gulch vermiculite project from Stansbury Holdings through the Sheriff's sales. The company has brought the project back into compliance with Federal and State regulations (Moeller and Hindman, 2005).

In February, International Business Investments Corporation (IBI) signed an option to acquire 5 square kilometers of vermiculite-bearing land located in Clarke County, NV. The property, called the Mica Peak deposit, is held by IBI's wholly owned subsidiary North American Vermiculite Inc. (NAVI). The new company NAVI was created by IBI for the sole purpose of operating the Mica Peak operation.

The Mica Peak deposit is located about 80 kilometers east of Las Vegas, NV, and is one of the few remaining vermiculite properties west of the Mississippi. The deposit comprises two large areas of altered schists on the sides of Mica Peak. The vermiculite is mostly fine grained and was formed by alteration of the biotite found in the ultramafic rocks associated with the schists. Laboratory testing of samples taken from the deposit shows no sign of asbestos. The contemplated date for the start up of the project is in early 2006 (Industrial Minerals, 2004a).

Consumption

Vermiculite has a wide range of uses that take advantage of its various attributes of fire resistance, good insulation, high liquid absorption capacity, inertness, and low density (table 3). Vermiculite is used in general building plasters, either in its own formulations or combined with other lightweight aggregates such as perlite. Special plasters include fire protection and acoustic products in which vermiculite is combined with a binder, such as gypsum or portland cement, and fillers and rheological aids.

Exfoliated vermiculite treated with a water repellent is used to fill pores and cavities in masonry construction (especially hollow blockwork) to enhance acoustic, fire rating, and insulation performance. Finer grades of exfoliated vermiculite are used to produce

[1]References that include a section mark (§) are found in the Internet References Cited section.

insulation shapes. The manufacturing process is very similar to that used for the production of silicate-bound building boards (Roskill Information Services Ltd., 1999, p. 84). Vermiculite-base insulation shapes can be used in lower temperature metal-melting-processing industries; vermiculite can be used in contact with molten metal up to 1,200° C. In particular, vermiculite shapes are used in the aluminum industry because vermiculite is said to have a nonwetting characteristic with aluminum (Russell, 2000, p. 16).

In horticulture, exfoliated vermiculite improves soil aeration and moisture retention. When vermiculite is mixed with peat or other composted materials, such as pine bark, the resulting product provides a good growing medium for plant propagation. As a soil conditioner, exfoliated vermiculite can improve the aeration of "sticky" soils (containing clay) and the water-holding characteristics of sandy soils. This allows for easier watering and reduces the likelihood of compaction, cracking, and crusting of the soil. Vermiculite is used in the fertilizer/pesticide market because of its ability to act as a carrier, bulking agent, and extender (Roskill Information Services Ltd., 1999, p. 81-91).

Finer grades of exfoliated vermiculite are used to partially replace asbestos in brake linings primarily for the automotive market (Roskill Information Services Ltd., 1999, p. 84).

Prices

Published prices for vermiculite serve only as a general guide because of variations in application, quantity, source, and other factors. Published prices for raw (unexpanded) U.S. vermiculite concentrate, bulk, ex-mill for the first half of 2004 varied between $143 and $220 per metric ton depending on particle size (Industrial Minerals, 2004b). In the second half of the year, there was a 25% to 30% increase in prices to a range of $187 to $276 per ton depending on particle size (Industrial Minerals, 2004c).

The average unit value of U.S. exfoliated vermiculite sold or used by producers, using actual and estimated data, was about $390 per ton, which was a composite value that included both U.S. and imported material (table 1). This was a 5% increase in price compared with that in 2003.

Foreign Trade

Trade data for vermiculite concentrate are not collected as a separate category by the U.S. Census Bureau but are included within the basket category "vermiculite, perlite, and chlorite, unexpanded" under Harmonized Tariff Schedule of the United States code 2530.10.0000. According to the Journal of Commerce Port Import/Export Reporting Service, total U.S. imports of vermiculite in 2004 (excluding Canada and Mexico) were about 68,900 t (Commonwealth Business Media, Inc., 2005§). South Africa supplied about 69% of the tonnage, and China, about 30%.

World Review

Canada.—Regis Resources Inc. of Toronto, Ontario, Canada, opened a new vermiculite mine and mill complex near Cavendish in southern Ontario under the trade name Vermiculite Canada. This deposit is unlike all other commercial vermiculite deposits in that it is associated with a large-size marble deposit and not an ultramafic igneous or metamorphic deposits (Vermiculite Canada, 2005§). This is the first new vermiculite operation in North America since the late 1970s.

South Africa.—In February, Palabora Mining Company Limited undertook improvements at their vermiculite operations that increased the plant feed rate, and overall plant recovery improved by 20%. Daily production increased by 620 t, while quality was maintained. Production of about 190,000 t was 2% above plan and 11.6% better than 2003 (Palabora Mining Company Limited, 2004, p.15).

Outlook

According to Dickson (2004), U.S. vermiculite markets seem to have stabilized somewhat in 2003 after consumption declined to possibly as low as 140,000 t. U.S. consumption could continue to decline by as much as 2% per year because of reduced usage of vermiculite in potting soil and some industrial consumers moving operations overseas. No significant changes in pricing are expected. Prices could increase or decrease depending on changes in exchange rates or freight costs and if there is continuing downward price pressures in some markets.

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TABLE 1
SALIENT VERMICULITE STATISTICS[1]

(Thousand metric tons and thousand dollars unless otherwise specified)

		2000	2001	2002	2003	2004
United States:						
Production:[2]						
Concentrate[e]		150	110 [r]	100 [r]	110 [r]	100
Exfoliated:[e]						
Quantity		165	140	115	95	90
Value[e]		53,200	48,000	44,900	34,800	35,400
Average value[e, 3]	dollars per metric ton	322	340	390	370	390
Exports[e]		5	7	10	15	10
Imports for consumption[4]		59	65	56	37	69 [e]
World, production[5]		521 [r]	431 [r]	498 [r]	491 [r]	510 [e]

[e]Estimated. [r]Revised.

[1]Data are rounded to no more than three significant digits.

[2]Sold or used by producers.

[3]Based on rounded data.

[4]Source: Port Import/Export Reporting Services.

[5]Excludes production by countries for which data were not available.

TABLE 2
ACTIVE VERMICULITE EXFOLIATION PLANTS IN THE UNITED STATES IN 2004

Company	County	State
Isolatek International, Inc.	Sussex	New Jersey.
J.P. Austin Associates, Inc.	Beaver	Pennsylvania.
Palmetto Vermiculite Co., Inc.	Spartanburg	South Carolina.
P.V.P. Industries, Inc.	Trumbull	Ohio.
Scotts Company, The	Greenville	South Carolina.
Southwest Vermiculite Co., Inc.	Bernalillo	New Mexico.
Sun Gro Horticulture, Inc.	Jefferson	Arkansas.
Do.	La Salle	Illinois.
Schundler Co., The	Middlesex	New Jersey.
Thermal Ceramics Inc.	Macoupin	South Carolina.
Thermo-O-Rock East, Inc.	Washington	Pennsylvania.
Thermo-O-Rock West, Inc.	Maricopa	Arizona.
Verlite Co.	Hillsborough	Florida.
Vermiculite Industrial Corp.	Allegheny	Pennsylvania.
Vermiculite Products, Inc.	Harris	Texas.
Whittemore Co., Inc.	Essex	Massachusetts.
W.R. Grace & Co.	Maricopa	Arizona.
Do.	Broward	Florida.
Do.	Greenville	South Carolina.

TABLE 3
ESTIMATED EXFOLIATED VERMICULITE SOLD OR USED IN THE UNITED STATES, BY END USE[1]

(Metric tons)

	2003	2004
Aggregates[2]	24,800	24,300
Insulation[3]	W	W
Agricultural:		
Horticultural	20,600 r	22,200
Soil conditioning	25,000 r	22,800
Fertilizer carrier	W	W
Total	W	W
Other[4]	15,300	9,830
Grand total	95,000	90,000 [5]

rRevised. W Withheld to avoid disclosing company proprietary data; included in "Grand total."

[1]Data rounded to no more than three significant digits; may not add to totals shown.

[2]Includes concrete, plaster, and premixes (acoustic insulation, fireproofing, and texturizing uses).

[3]Includes loose-fill, block, and other (high-temperature and packing insulation and sealants).

[4]Includes various industrial and other uses not specified.

[5]Rounded to two significant digits because of estimated data.

TABLE 4
VERMICULITE: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Metric tons)

Country	2000	2001	2002	2003	2004[e]
Argentina	-- [r]	1,110	1,105	1,124	1,150
Australia[e]	12,000	12,000	12,000	12,000	12,000
Brazil, concentrate	24,074	21,464	22,577	26,055 [r]	26,100
China[e]	60,000 [r]	70,000 [r]	80,000 [r]	90,000 [r]	100,000
Egypt[e]	12,000	12,000	12,000	12,000	12,000
India[e]	4,200	4,300	4,300	4,400	4,400
Japan[e]	6,500 [r]	6,400 [r]	6,200 [r]	6,200 [r]	6,000
Kenya[e]	124 [3, 4]	--	--	--	--
Malawi	--	1	1 [e]	1 [e]	1
Russia[e]	25,000	25,000	25,000	25,000	25,000
South Africa	208,835	156,632	210,297	182,802	194,515 [4]
Uganda	--	220	664	1,724	2,000
United States, concentrate, sold and used by producers[e]	150,000	110,000 [r]	100,000 [r]	110,000 [r]	100,000
Zimbabwe	18,935	11,632	23,803	20,016	27,150 [4]
Total	521,000 [r]	431,000 [r]	498,000 [r]	491,000 [r]	510,000

[e]Estimated. [r]Revised. -- Zero.

[1]World totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Excludes production by countries for which data are not available and for which general information is inadequate for formulation of reliable estimates. Table includes data available through July 15, 2005.

[3]Reported exports.

[4]Reported figure.